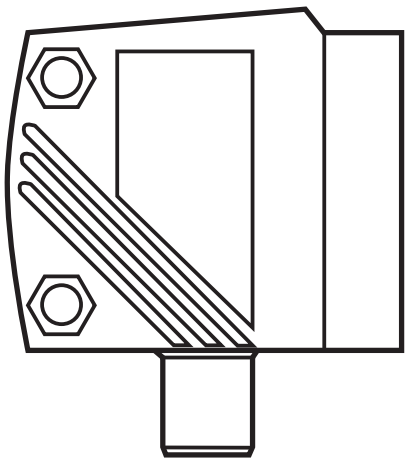
ifm electronic

CE

Operating instructions
Optical distance sensor
efector200
O1D105

UK



704203 / 01 05 / 2010

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1 Preliminary note

1.1 Symbols used

▶ Instruction

> Reaction, result

[…] Designation of pushbuttons, buttons or indications

→ Cross-reference

Important note
Non-compliance can result in malfunction or interference.

Information
Supplementary note.

1.2 Warning signs used

⚠ WARNING

Warning of serious personal injury.
Death or serious irreversible injuries may result.

2 Safety instructions

- Please read this document prior to set-up of the unit. Ensure that the product is suitable for your application without any restrictions.
- Improper or non-intended use may lead to malfunctions of the unit or to unwanted effects in your application. That is why installation, electrical connection, set-up, operation and maintenance of the unit must only be carried out by qualified personnel authorised by the machine operator.
- In case of malfunction of the unit please contact the manufacturer. If the unit is tampered with and/or modified, any liability and warranty is excluded.

⚠ WARNING

Visible laser light; laser protection class 2.

Use of controls or adjustments other than those specified herein may result in hazardous radiation exposure. Damage to the retina is possible.

- ▶ Do not stare into the laser beam!
- ▶ Apply the enclosed labels (laser warning) in the immediate vicinity of the unit.
- ▶ Adhere to the caution and warning notes on the product label.
- ▶ Use the enclosed label for the power supply cable.

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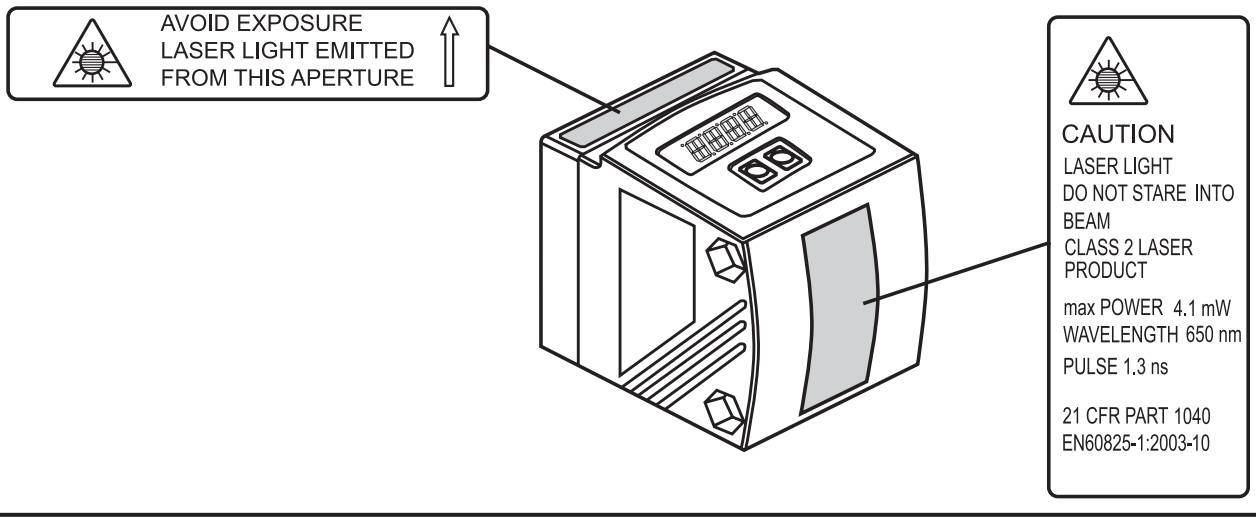
Label for supply cable

Product label



3 Functions and features

The unit is used as an optical distance sensor.

3.1 Application areas

- The optical distance sensor measures distances between 0.2...10 m.
- It has a background suppression at >10...100 m.
- The measured value is shown in a 10-segment display.
- Two output signals can be generated depending on the set output function.

The distance between the sensor and the background must be limited to max. 100 m by the customer. Otherwise measured values can be ambiguous. → 5.1 Installation conditions

4 Modes

4.1 Hysteresis function mode

The hysteresis keeps the switching state of the output stable if the measured value varies about the sensing range. Both outputs (OUT1 and OUT2) can be set as hysteresis function. → 9.2.4 Hysteresis function

4.2 Window function mode

The window function enables the monitoring of a defined acceptable range. Both outputs (OUT1 and OUT2) can be set as window function. → 9.2.6 Window function

4.3 Analogue function mode

An analogue signal, which is proportional to the distance, can be provided at output 2 (OUT2). → 9.2.11 Scaling of the measuring range (analogue output).

5 Installation

5.1 Installation conditions

▶ Install the unit so that the object to be detected is within a measuring range of 0.2...10 m.

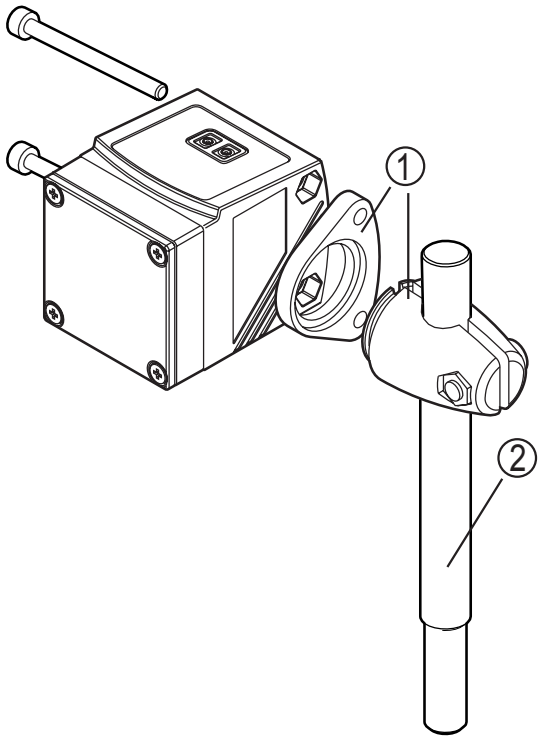
The unambiguity range of the sensor is fixed to 100 m. Objects within a range > 10...100 m are suppressed.

Reflecting objects in the direct beam path of the sensor - also in the range > 100 m – are to be avoided by the customer. Otherwise the measured values can be ambiguous.

5.2 Mounting accessories

The unit is supplied without mounting accessories.

Examples of mounting accessories	Art. no.
Protective cover O1D	E21133
Mounting set E2D101 + E20938 + E20951	E21079
Mounting set O1D (for rod mounting Ø 12 mm)	E2D101
Mounting rod straight Ø 12 mm / M10	E20938
Mounting set O1D (for rod mounting Ø 14 mm)	E2D111
Mounting rod straight Ø 14 mm / M12	E20939
Fixture for mounting and fine adjustment of O1D laser units	E1D100



Example mounting:

1: Mounting set for rod Ø 12 mm
Art. no. E2D101
2: Mounting rod straight Ø 12 mm / M10
Art. no. E20938

6 Electrical connection

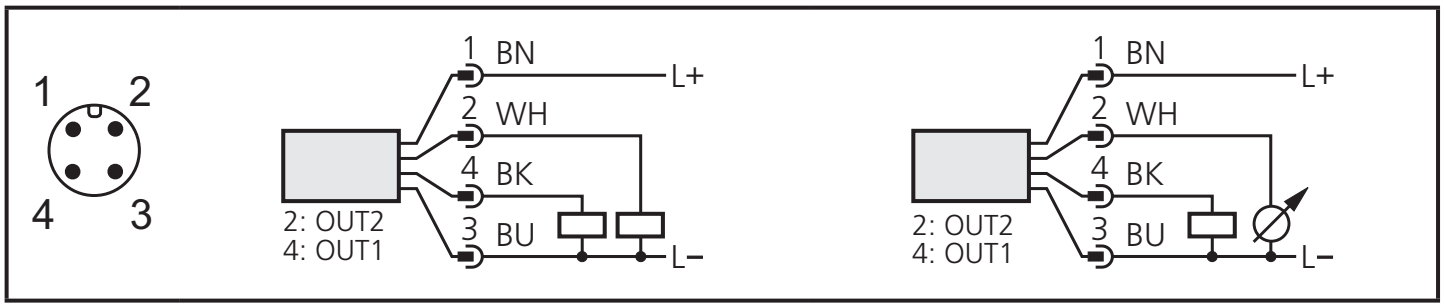
The unit must be connected by a qualified electrician.

- ▶ The national and international regulations for the installation of electrical equipment must be adhered to.
- ▶ Ensure voltage supply to EN 50178, SELV, PELV.

▶ Disconnect power.

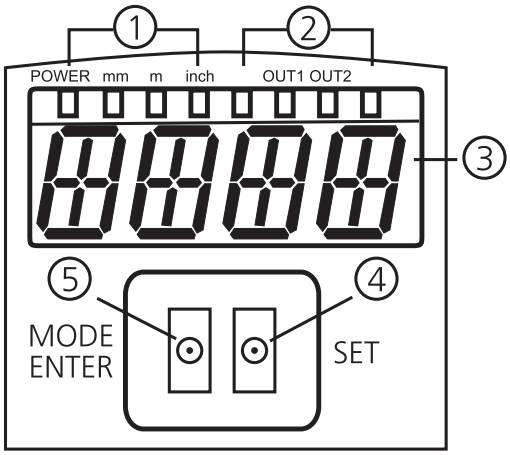
▶ Connect the cable as follows:

DC PNP



Core colours of ifm sockets:
1 = BN (brown), 2 = WH (white), 3 = BU (blue), 4 = BK (black)

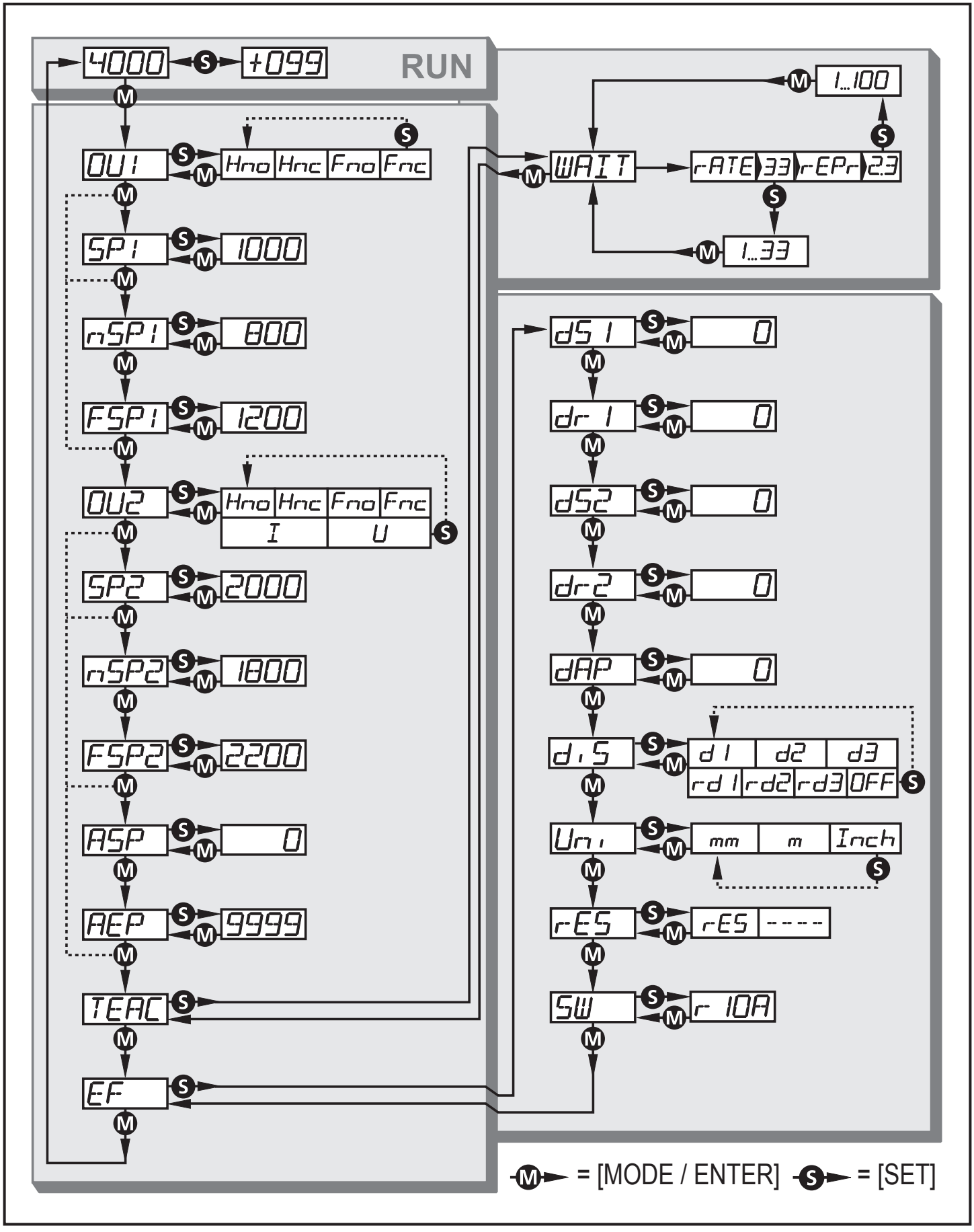
7 Operating and display elements



1: 4 x LED green	Lighting LED = power and set display unit (mm, m, inch)
2: 4 x LED yellow (two not connected)	Indication of the switching state; lights, if the corresponding output is switched.
3: 4-digit alphanumeric display	Indication of the measured distance, the parameters and parameter values.
4: Programming button [SET]	Setting of the parameter values (scrolling by holding pressed; press briefly to increment).
5: Programming button [MODE/ ENTER]	Selection of the parameters and acknowledgement of the parameter values.

8 Menu

8.1 Menu structure



8.2 Explanation of the menu

For the factory settings please refer to the end of these instructions (→ 13 Factory setting).

OU1	**Configuration for output 1** 4 switching functions can be selected: [Hno], [Hnc], [Fno], [Fnc] → 9.2.3 Configure OUT1
SP1	**Switch point for hysteresis function OUT1** Limit value at which the output with selected hysteresis function changes its switching state (object nearer / farther than distance set). [SP1] is only active if [OU1] = [Hno] or [Hnc]. → 9.2.5 Setting of the switch point for hysteresis function OUT1
nSP1 FSP1	**Switch points for window function OUT1** Limit values at which the output with selected window function changes its switching state (object present / not present between the distance "near" and the distance "far"). [nSP1] = switch point "near" / [FSP1] = switch point "far". [nSP1] / [FSP1] are only active if [OU1] = [Fno] or [Fnc]. → 9.2.7 Setting of the switch points for window function OUT1
OU2	**Configuration for output 2** 4 switching functions and 2 analogue signals can be selected: [Hno], [Hnc], [Fno], [Fnc], [I], [U] → 9.2.8 Configure OUT2
SP2	**Switch point for hysteresis function OUT2** Limit value at which the output with selected hysteresis function changes its switching state (object nearer / farther than distance set). [SP2] is only active if [OU2] = [Hno] or [Hnc]. → 9.2.9 Setting of the switch point for hysteresis function OUT2
nSP2 FSP2	**Switch points for window function OUT2** Limit values at which the output with selected window function changes its switching state (object present / not present between the distance "near" and the distance "far"). [nSP2] = switch point "near" / [FSP2] = switch point "far". [nSP2] / [FSP2] are only active if [OU2] = [Fno] or [Fnc]. → 9.2.10 Setting of the switch points for window function OUT2
ASP	**Analogue start point** Measured value at which 4 mA / 0 V are provided. [ASP] is only active if [OU2] = [I] or [U]. → 9.2.11 Scaling of the measuring range (analogue output)

AEP	**Analogue end point** Measured value at which 20 mA / 10 V are provided. [AEP] is only active if [OU2] = [I] or [U]. → 9.2.11 Scaling of the measuring range (analogue output)
TEAC	**Teach mode** Selection "sampling rate" or "repeatability" → 9.3 Teach mode

EF	**Extended functions** Press [SET] to open the submenu "Extended functions" → 9.4. Extended functions
dS 1 dr 1 dS2 dr2	**Delay for the switching outputs** [dSx] = switch-on delay; [drx] = switch-off delay. The output does not immediately change its switching state when the switching condition is met but only after the delay has elapsed. If the switching condition is no longer met after the delay has elapsed, the switching state of the output does not change. [dS2] and [dr2] are not effective if [OU2] = [I] or [U]. → 9.4.1 Setting of the time delay for switching outputs
dAP	**Damping of the measured signal** This function allows to suppress short-time saturation of the measuring element (such saturation can result from direct reflection or strong fluctuations in brightness). During the set delay time, the latest valid value measured is displayed, the output signals remain unchanged. → 9.4.2 Setting of the damping of the measured signal
di S	**Setting of the display** 7 settings can be selected: [d1], [d2], [d3], [rd1], [rd2], [rd3], [OFF] → 9.2.2 Setting the display
Unı	**Setting of the display unit** Selection of the unit of measurement for [SP1], [SP2], [ASP], [AEP] Options: [mm] [m] [inch] → 9.2.1 Selection of the display unit
rES	**Restore the factory setting** → 9.4.2 Reset of all parameters to factory setting
SW	**Display of the software version number** → 9.4.4 Display of the software version number

9 Parameter setting

During parameter setting the unit remains internally in the operating mode. It continues its monitoring function with the existing parameters until the change has been completed.

9.1 General parameter setting

9.1.1 Setting a parameter value

Set the display unit [Uni] before the values for the parameters are defined. In case of subsequent changes of the display unit rounding errors during internal conversion to other units may falsify the set values. → 9.2.1 Selection of the display unit.

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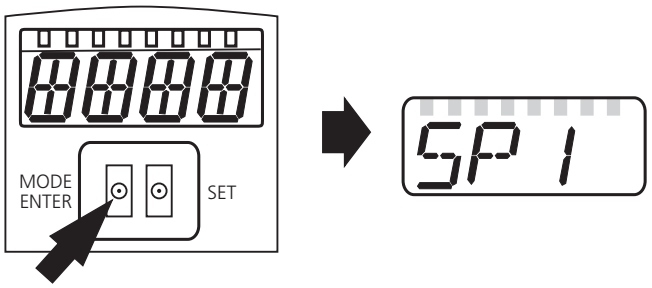
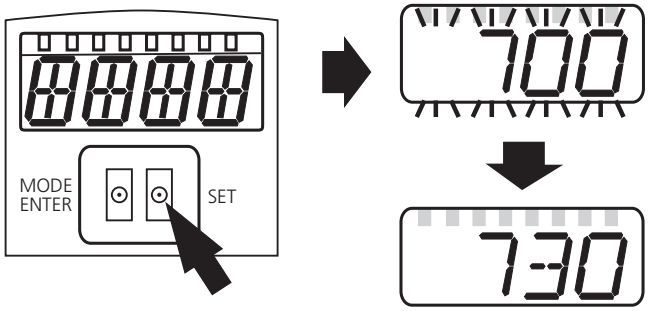
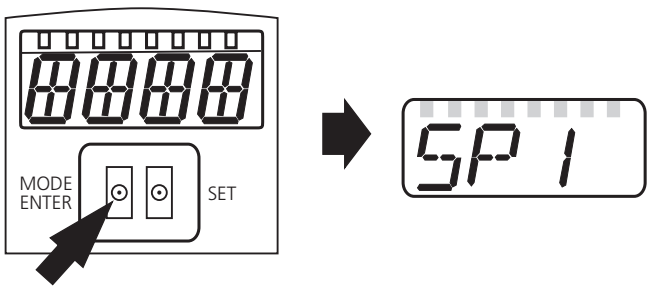
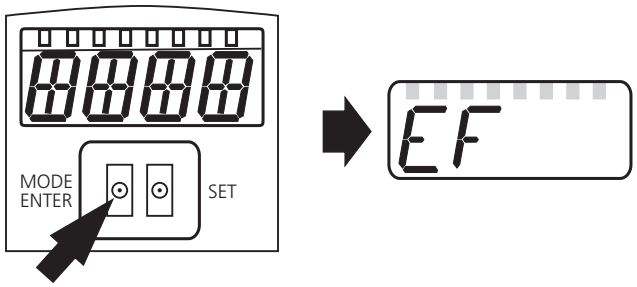
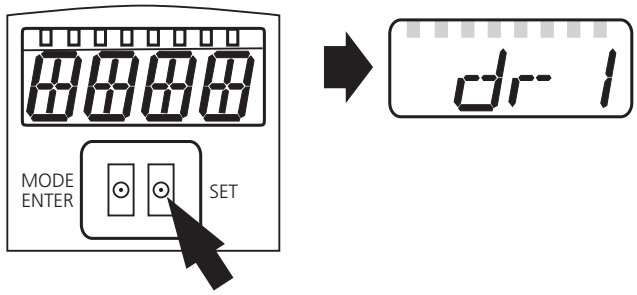
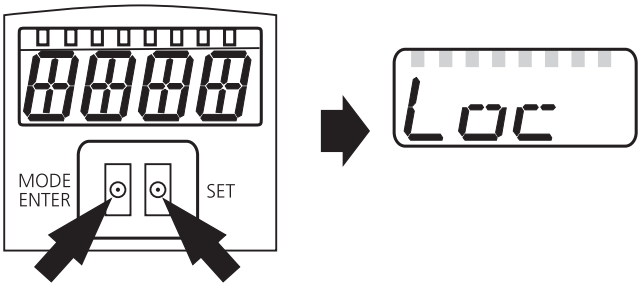
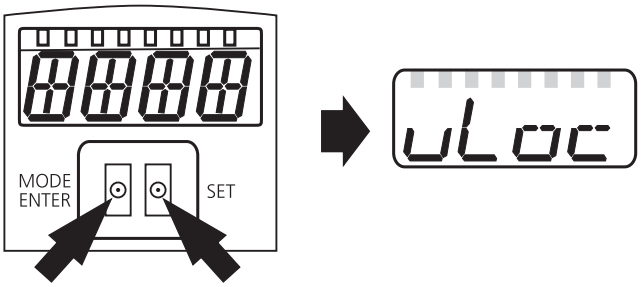
1	**Selection of the parameter** ▶ Press [MODE/ENTER] until the requested parameter is displayed.	
2	**Setting of the parameter value** ▶ Press [SET] and keep it pressed. > The current parameter value flashes for 5 s. ▶ Increase the setting value step by step by pressing the button once or continuously by holding it down.	
	Decrease the value: let the display move to the maximum setting value. Then the cycle starts again at the minimum setting value.	
3	**Confirmation of the parameter value** ▶ Press [MODE/ENTER] briefly. > The parameter is displayed again; the new parameter value is effective.	
4	**Setting of other parameters** ▶ Start again with step 1.	
5	**Finish parameter setting** ▶ Wait for 15 s or press [MODE/ENTER]. > The current measured value is displayed.	

9.1.2 Change from menu level 1 to menu level 2

▶ Press [MODE/ENTER] several times until [EF] is displayed.	
▶ Press [SET] briefly. > The first parameter of the submenu is displayed (here:[dr1]).	

9.1.3 Electronic lock

The unit can be locked electronically to prevent unauthorised setting. On delivery the unit is not locked.

Locking ▶ Make sure that the unit is in the normal operating mode. ▶ Keep [MODE/ENTER] + [SET] pressed until [Loc] is displayed. > The unit is locked.	
[Loc] is displayed briefly if you try to change parameter values on the locked unit during operation.	
Unlocking ▶ Keep [MODE/ENTER] + [SET] pressed until [uLoc] is displayed. > The unit is unlocked.	

Timeout

If no button is pressed for 15 s during the setting procedure, the unit returns to the Run mode with unchanged values.

9.2 Configuration of the basic settings

9.2.1 Selection of the display unit

Set [Uni] before the values for the parameters [SPx], [nSPx], [FSPx], [ASP], [AEP] are defined. In case of subsequent changes of the display unit rounding errors during internal conversion to other units may falsify the set values. ▶ Change to [EF]. ▶ Select [Uni] and set the unit of measurement. Selection of the unit of measurement: [mm], [m], [inch] ▶ Confirm with [MODE/ENTER]. > The selected unit is indicated by a green LED on the display.	

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9.2.2 Setting the display

▶ Change to [EF]. ▶ Select [diS] and make settings. 7 settings can be selected: • [d1] = update of the measured values every 50 ms. • [d2] = update of the measured values every 200 ms. • [d3] = update of the measured values every 600 ms. • [rd1], [rd2], [rd3] = display like [d1], [d2], [d3] but rotated by 180°. The update of the measured value only refers to the display. It has no effect on the outputs. • [OFF] = the measured value display is deactivated in the Run mode. When one button is pressed the current measured value is displayed for 15 s. ▶ Confirm with [MODE/ENTER]. The LEDs remain active even if the display is deactivated.	

9.2.3 Configure OUT1

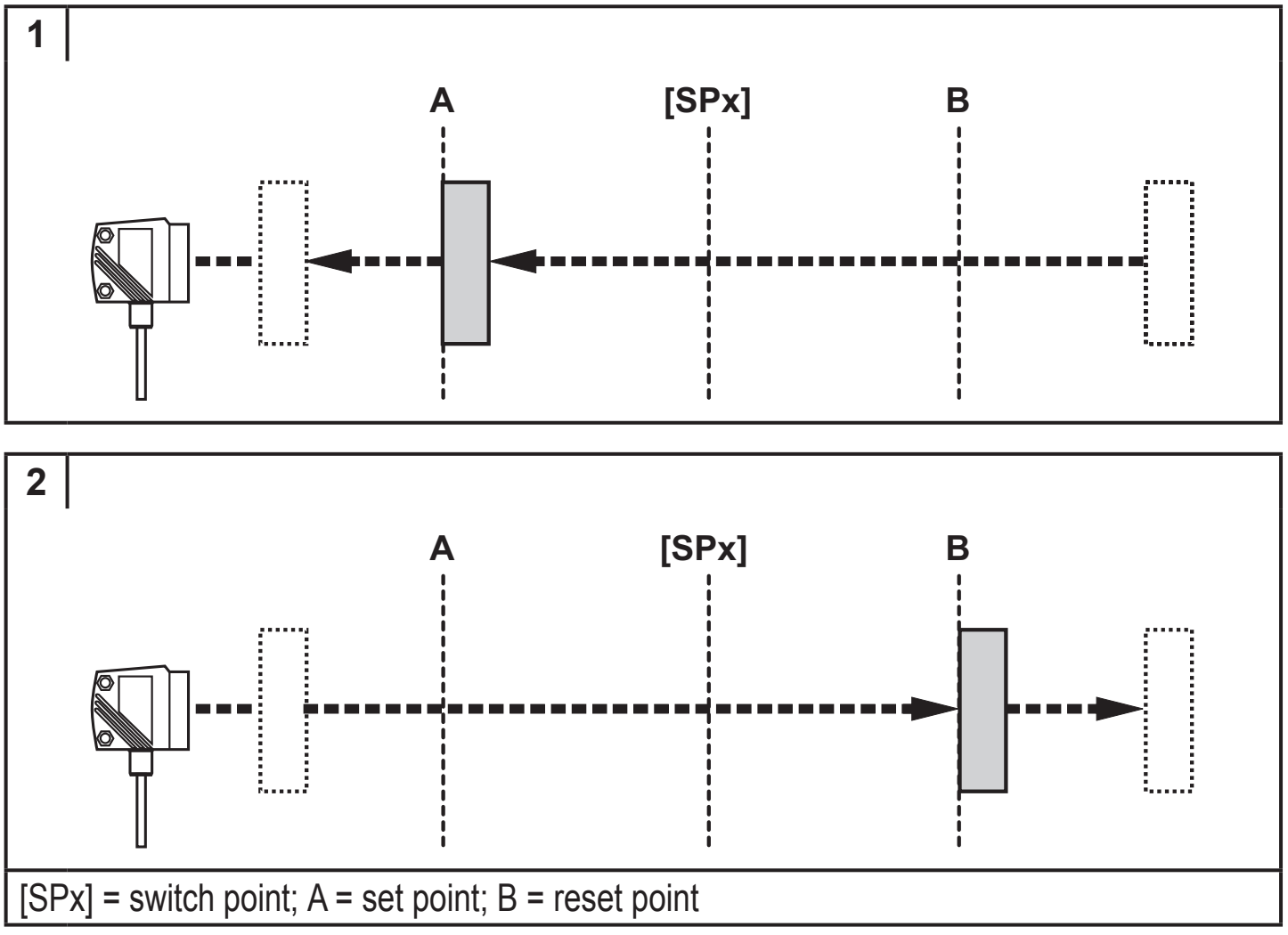
▶ Select [OU1] and set the switching functions. Switching functions: • [Hno] = hysteresis function / normally open • [Hnc] = hysteresis function / normally closed • [Fno] = window function / normally open • [Fnc] = window function / normally closed ▶ Confirm with [MODE/ENTER].	

9.2.4 Hysteresis function

The hysteresis keeps the switching state of the output stable if the measured value varies about the sensing range. In both cases the set and reset points are symmetrically arranged about the selected switch point [SPx]. The hysteresis is the distance between set and reset points; it is calculated on the basis of the repeatability with a safety factor of 1.5.

Example Hno

1. For the output function [Hno] the output switches when the object approaches and when the set point (A) is reached.
2. When the object is removed again, the output does not switch back before the reset point (B) is exceeded.
   The reset point (B) is above the set point (A).



[SPx] = switch point; A = set point; B = reset point

If the output function [Hnc] has been selected, the set and reset points are reversed. The output switches off when the object approaches. When the object is removed again, the output switches.

Switching state of the outputs

Output function	Object distance (D)	Output status
[Hno]	D < [SPx]	closed
	D > [SPx]	open
[Hnc]	D < [SPx]	open
	D > [SPx]	closed

Example of output function [Hno]
Sampling rate 15 Hz, distance to the object 1200 mm, grey value (18 % remission):
Hysteresis = ± 8 mm (repeatability → 9.3.3 table) x factor 1.5 = 12 mm
- Reset point 1200 mm + (12 mm) = 1212 mm
- Set point 1200 mm - (12 mm) = 1188 mm

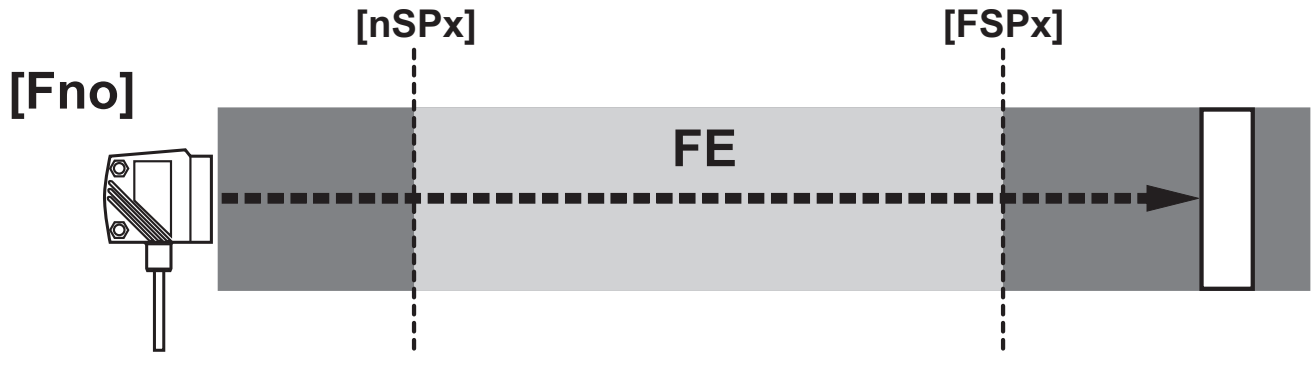
9.2.5 Setting of the switch point for hysteresis function OUT1

- ▶ In [OU1] select the output function [Hno] or [Hnc].
- ▶ Confirm with [MODE/ENTER].
- ▶ Select [SP1] and set the switch point.
- ▶ Confirm with [MODE/ENTER].

9.2.6 Window function

It is possible to define a window for the object recognition for each of the two outputs (OUT1 / OUT2).

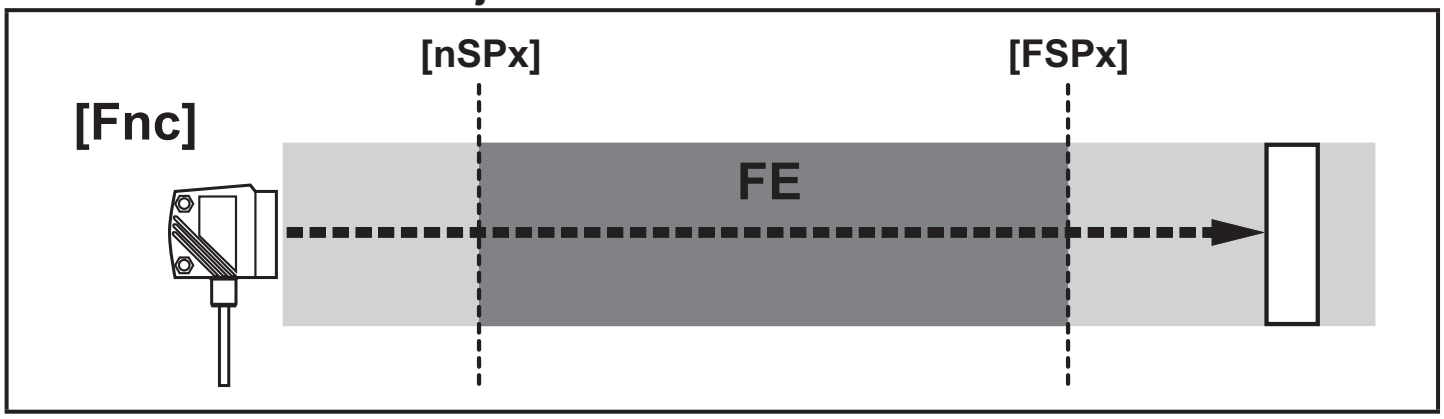
Switches when the object is detected



[nSPx] = switch point "near"; [FSPx] = switch point "far"; FE = window

If the measured value is between the switch point "near" [nSPx] and the switch point "far" [FSPx], the output is closed (when [OUx] = [Fno]).

Switches off when the object is detected



[nSPx] = switch point "near"; [FSPx] = switch point "far"; FE = window

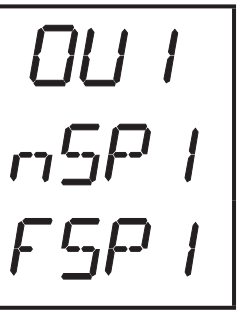
If the measured value is between the switch point "near" [nSPx] and the switch point "far" [FSPx], the output is open (when [OUx] = [Fnc]).

Switching state of the outputs

Output function	Object distance (D)	Output status
[Fno]	D < [nSPx] D > [FSPx]	open
	[nSPx] < D < [FSPx]	closed
[Fnc]	D < [nSPx] D > [FSPx]	closed
	[nSPx] < D < [FSPx]	open
Both window limit values ([nSPx] and [FSPx]) work with a switching hysteresis → 9.2.4 Hysteresis function / example for output function [Hno].		

9.2.7 Setting of the switch points for window function OUT1

- ▶ In [OU1] select the output function [Fno] or [Fnc].
- ▶ Confirm with [MODE/ENTER].
- ▶ Select [nSP1] and set the switch point "near".
- ▶ Confirm with [MODE/ENTER].
- ▶ Select [FSP1] and set the switch point "far".
- ▶ Confirm with [MODE/ENTER].



9.2.8 Configure OUT2

- ▶ Select [OU2].
- ▶ Set switching functions or analogue signals:
  - [Hno] = hysteresis function / normally open
  - [Hnc] = hysteresis function / normally closed
  - [Fno] = window function / normally open
  - [Fnc] = window function / normally closed
  - [I] = current output analogue 4...20 mA
  - [U] = voltage output analogue 0...10 V
- ▶ Confirm with [MODE/ENTER].

9.2.9 Setting of the switch point for hysteresis function OUT2

- ▶ In [OU2] select [Hno] or [Hnc].
- ▶ Confirm with [MODE/ENTER].
- ▶ Select [SP2] and set the switch point.
- ▶ Confirm with [MODE/ENTER].

→ 9.2.4 Hysteresis function

9.2.10 Setting of the switch points for window function OUT2

- ▶ In [OU2] select [Fno] or [Fnc].
- ▶ Confirm with [MODE/ENTER].
- ▶ Select [nSP2] and set the switch point "near".
- ▶ Confirm with [MODE/ENTER].
- ▶ Select [FSP2] and set the switch point "far".
- ▶ Confirm with [MODE/ENTER].

→ 9.2.6 Window function

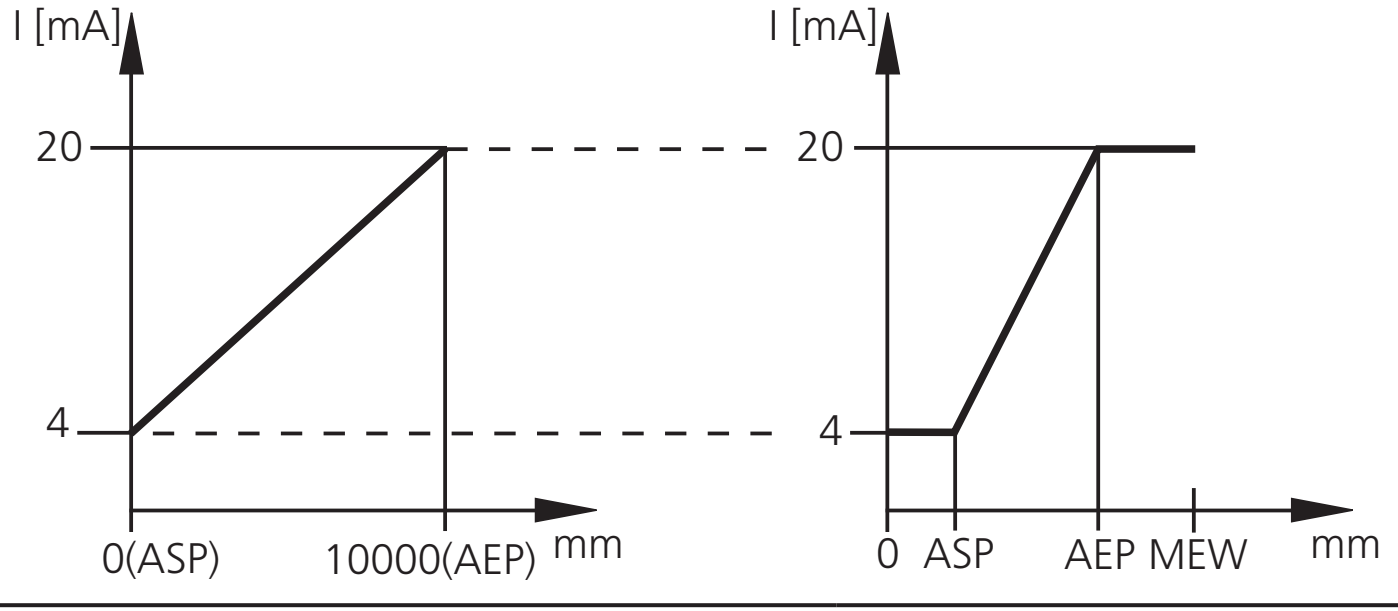
9.2.11 Scaling of the measuring range (analogue output)

- ▶ In [OU2] select [I] or [U].
- ▶ Confirm with [MODE/ENTER].
- ▶ Select [ASP] and set the "Analogue start point".
  With [ASP] you define at which measured value the output signal is 4 mA / 0 V.
- ▶ Confirm with [MODE/ENTER].
- ▶ Select [AEP] and set the "Analogue end point".
  With [AEP] you define at which measured value the output signal is 20 mA / 10 V. It can also be selected so that it is before [ASP]. This implements a falling edge.
- ▶ Confirm with [MODE/ENTER].

Minimum distance between [ASP] and [AEP]: 100 mm
When the minimum distance is not reached, the error message "SIZE" is displayed.

Current output 4 ... 20 mA

Factory setting	Measuring range scaled



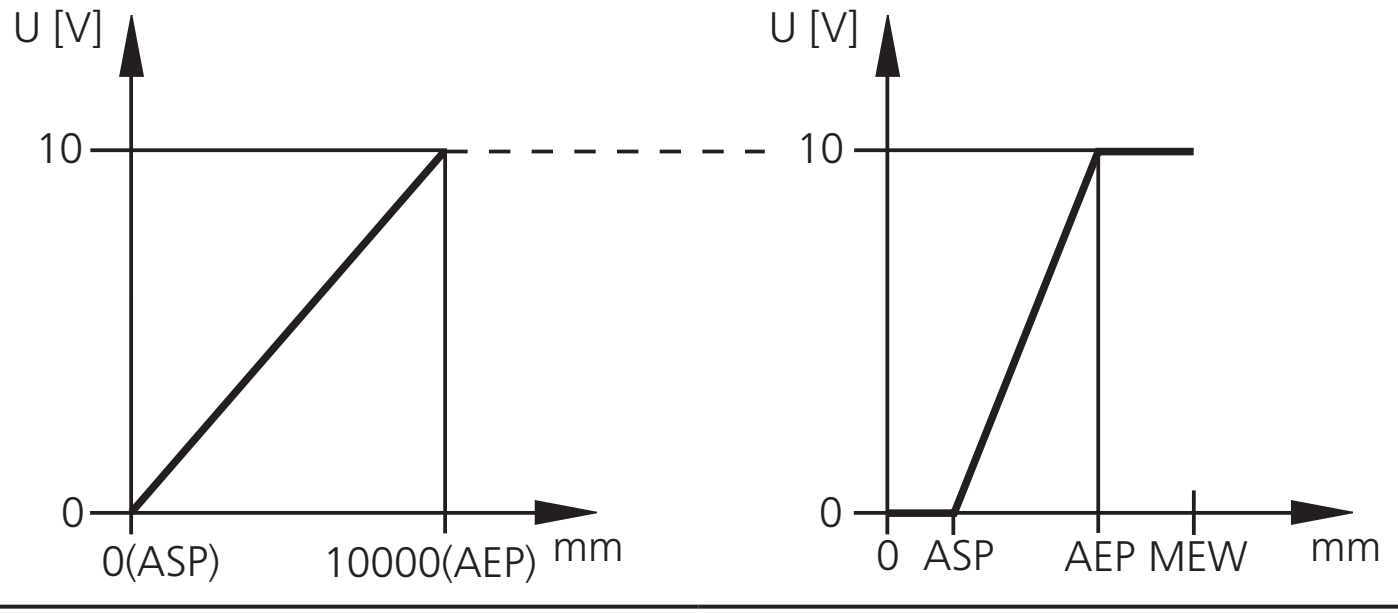
MEW = final value of the measuring range

In the set measuring range the output signal is between 4 and 20 mA.

Faults are also displayed:
Too much light or object too near: 3.5 mA for a rising edge ([ASP] < [AEP]), 20.5 mA for falling edge ([ASP] > [AEP]).
Object too far or no object present:
20.5 mA for rising edge; 3.5 mA for falling edge.

Voltage output 0 ... 10 V

Factory setting	Measuring range scaled



MEW = final value of the measuring range

In the set measuring range the output signal is between 0 and 10 V.

9.3 Teach mode

9.3.1 Setting of the sampling rate

The sampling rate indicates the maximum time after which a new result of measurement is provided and the outputs are updated.
The switching frequency is typ. approx. 1/3 of the sampling rate.

- ▶ Select [TEAC], then press [SET] and keep pressed until [WAIT] is displayed.
- > [rATE] and [rEPr] are displayed alternately.
- ▶ When [rATE] is displayed: press [SET] until the preset sampling rate value flashes.
- ▶ Enter a value incrementally by pressing [SET] once.
- ▶ Confirm with [MODE/ENTER].
- > [WAIT] is displayed while the repeatability [rEPr] is calculated.
- > The sampling rate [rATE] and repeatability [rEPr] are displayed alternately.

UK

9.3.2 Setting of the repeatability

- ▶ Select [TEAC], then press [SET] and keep pressed until [WAIT] is displayed.
- > [rATE] and [rEPr] are displayed alternately.
- ▶ When [rEPr] is displayed: press [SET] until the preset repeatability value flashes.
- ▶ Enter a value incrementally by pressing [SET] once.
- ▶ Confirm with [MODE/ENTER].
- > [WAIT] is displayed while the sampling rate [rATE] is calculated.
- > The sampling rate [rATE] and repeatability [rEPr] are displayed alternately.

9.3.3 Table repeatability and accuracy

Values for sampling rate 15 Hz*

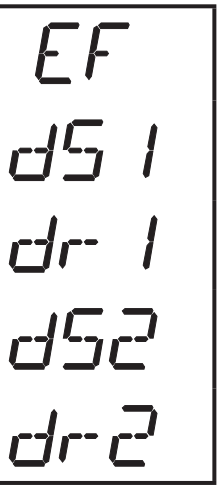
Distance in [mm]	Repeatability		Accuracy	
	white 90 % remission	grey 18 % remission	white 90 % remission	grey 18 % remission
200...1000	± 4.5 mm	± 6.0 mm	± 15.0 mm	± 16.0 mm
1000...2000	± 5.0 mm	± 8.0 mm	± 15.0 mm	± 18.0 mm
2000...4000	± 16.0 mm	± 19.0 mm	± 25.0 mm	± 30.0 mm
4000...6000	± 24.0 mm	± 33.0 mm	± 35.0 mm	± 45.0 mm
6000...10000	± 50.0 mm	—	± 65.0 mm	—

*Range referred to black (6 % remission) ≤ 4000 mm.
The values apply at:
- constant ambient conditions (23° C / 960 hPa)
- extraneous light on the object max. 8 klx
- only after unit powered up for 10 minutes.

9.4 Extended functions

9.4.1 Setting of the delay time for switching outputs

- ▶ Select [EF].
- ▶ Press [SET] to change to the menu [EF].
- ▶ Select parameters with [MODE/ENTER]:
  [dSx] = switch-on delay; [drx] = switch-off delay
- ▶ Set the parameter value with [SET]:
  Setting range [s]: 0 / 0.1...5 s in steps of 0.1 s
  (0 = delay time is not active)
- ▶ Confirm with [MODE/ENTER].



9.4.2 Setting of the damping of the measured signal

- ▶ Select [EF].
- ▶ Press [SET] to change to the menu [EF].
- ▶ Select [dAP].
- ▶ Set the parameter value with [SET]:
  Setting range [s]: 0.0...1.0...5.0.
- ▶ Confirm with [MODE/ENTER].

9.4.3 Reset all parameters to factory setting

▶ Select [EF]. ▶ Press [SET] to change to the menu [EF]. ▶ Select [rES], then press [SET] and keep it pressed until [----] is displayed. ▶ Confirm with [MODE/ENTER]. > The unit changes to the Run mode.	EF rES

9.4.4 Display of the software version number

▶ Select [EF]. ▶ Press [SET] to change to the menu [EF]. ▶ Select [SW], then press [SET]. > The software version number is displayed. ▶ Press [MODE/ENTER] to return to the menu [EF].	EF SW

UK

10 Operation

10.1 Set-up

▶ After installation, electrical connection and programming, check whether the unit operates correctly.

> If the unit has been correctly set up, the distance to the object is indicated.

Lifetime of a laser diode: 50000 hours.

10.1.1 Error indications

Display	Possible Cause	Switching output				Current output / voltage output	
		[Hno]	[Hnc]	[Fno]	[Fnc]	[ASP] < [AEP]	[ASP] > [AEP]
[++]	too much light, e.g. reflective surface	ON	OFF	OFF	ON	3.5 mA / 0 V	20.5 mA / 10 V
[- -]	not enough light, no object	OFF	ON	OFF	ON	20.5 mA / 10 V	3.5 mA / 0 V
[nEAr]	object to be measured outside the measuring range < 0.2 m	ON	OFF	OFF	ON	3.5 mA / 0 V	20.5 mA / 10 V

Display	Possible Cause	Switching output				Current output / voltage output	
		[Hno]	[Hnc]	[Fno]	[Fnc]	[ASP] < [AEP]	[ASP] > [AEP]
[FAr]	object to be measured outside the measuring range > 10 m	OFF	ON	OFF	ON	20.5 mA / 10 V	3.5 mA / 0 V
[Errp]	plausibility (e.g. object too fast)	X[1)]	X[1)]	X[1)]	X[1)]	X[1)]	X[1)]
[SC1]	short circuit in switching output 1					[1)]	[1)]
[SC2]	short circuit in switching output 2					[2)]	[2)]
[SC]	short circuit in all switching outputs					[2)]	[2)]

[1)] unchanged
[2)] [SC2] or [SC] only active if output 2 is configured as switching output.

10.2 Operating modes

10.2.1 Run mode

The run mode is the normal operating mode.

After power on the unit is in the Run mode. It carries out its monitoring function and generates output signals according to the set parameters.

The display indicates the current distance, the yellow LEDs signal the switching state of the outputs.

Display of the orientation value for the signal strength

▶ Press [SET] in the Run mode.

> The unit displays an orientation value for the signal strength (+100 corresponds to a white object, +020 corresponds to a grey object).

10.2.2 Display mode

Indication of the parameters and the set parameter values.

▶ Press [MODE/ENTER] briefly.

> The unit goes to the display mode. Internally it remains in the operating mode. The set parameter values can be read:

▶ To scroll through the parameters, press [MODE/ENTER] briefly.

▶ To display the respective parameter value, press [SET] briefly.

> After another 15 s the unit returns to the Run mode.

10.2.3 Programming mode

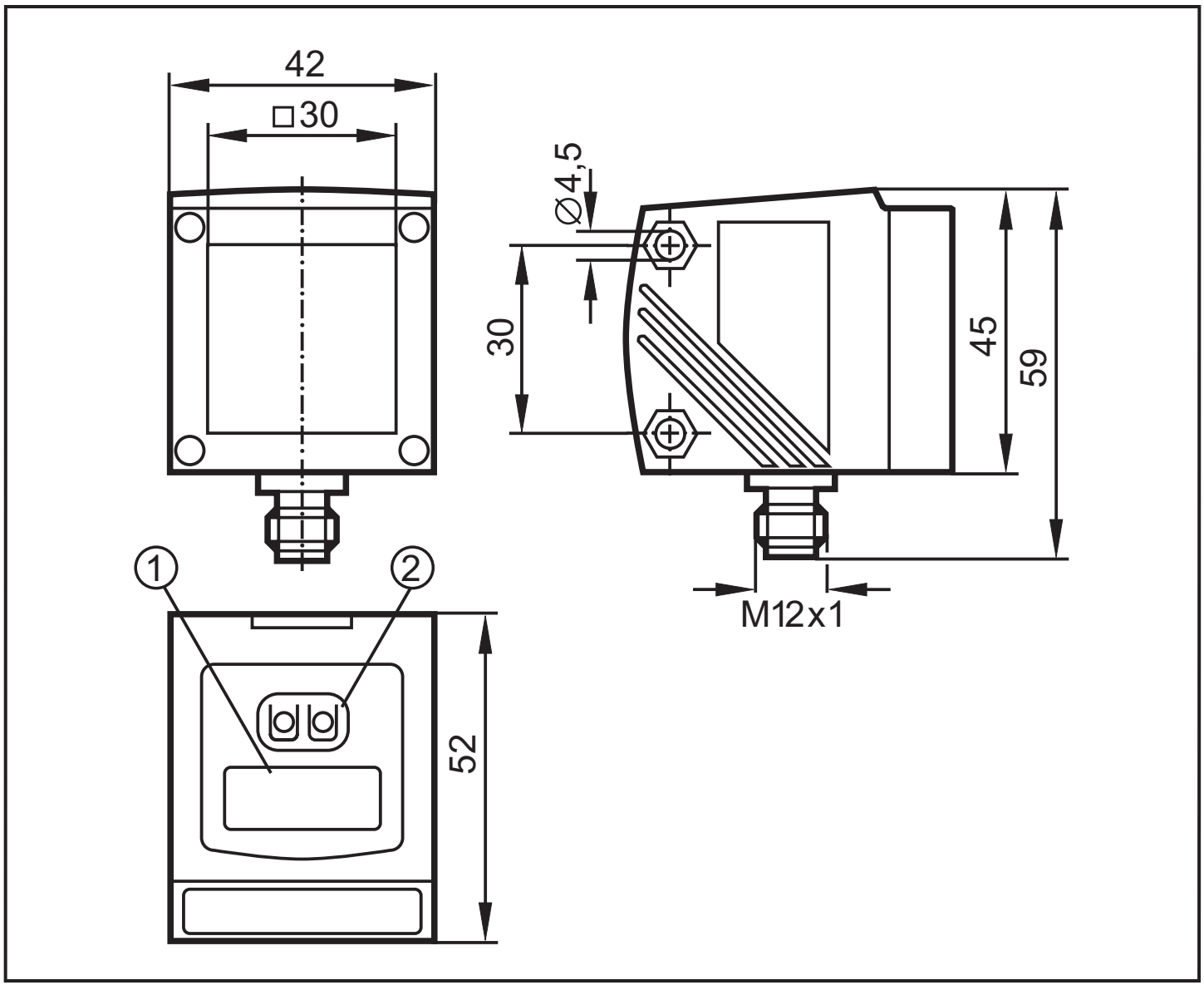
Setting the parameter values → 9.1 General parameter setting.

11 Maintenance, repair, disposal

Faulty sensors must only be repaired by the manufacturer.

- ▶ Keep the front lens of the sensor clean.
- ▶ After use dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.

12 Scale drawing



Dimensions in mm

1: 4-digit alphanumeric display / LED function display
2: programming buttons

13 Factory setting

Parameter	Setting range	Factory setting	Own setting
Uni	mm, m, inch	mm	
OU1	Hno, Hnc, Fno, Fnc	Hno	
SP1	200...9999	1000	
nSP1	200...9999	800	
FSP1	200...9999	1200	
OU2	Hno, Hnc, Fno, Fnc, I, U	I	
SP2	200...9999	2000	
nSP2	200...9999	1800	
FSP2	200...9999	2200	
ASP	0...9999	0	
AEP	0...9999	9999	
rATE	1...33	15 Hz	
dS1	0...0.1...5	0 s	
dr1	0...0.1...5	0 s	
dS2	0...0.1...5	0 s	
dr2	0...0.1...5	0 s	
dAP	0...0.1...5	0 s	
diS	d1...3; rd1...3; OFF	d3	

Technical data and further information at www.ifm.com